ERIC P. NEWMAN NUMISMATIC EDUCATION SOCIETY

6450 Cecil Avenue, St. Louis, Missouri 63105

January 31, 1992

Mr. Harry Salyards
606 N. Minnesota Ave.
Hastings, NE 68901

Dear Harry:

In order to try to make my talk at the Educational Forum of the St. Louis EAC Convention have a broader appeal, I am selecting as its title "Centering Planchets for Early U.S. Mint and State Copper Coinage." Please include this in the next PENNYWISE and in the program. The audience will be asked to participate. This should be of interest to the U.S. copper collectors.

I will gladly participate in a "general interest" forum if that is arranged. You indicated you might want that.

Kindest regards,

Eric /bv

Eric P. Newman

EPN:bv

Washington
WASHINGTON·UNIVERSITY·IN·ST·LOUIS

Department of Chemistry

February 2, 1992

Mr. Eric P. Newman
6450 Cecil
Clayton, MO 63105

Dear Eric,

It was nice to hear your voice a few days ago. I hope that your operation went smoothly and that you are feeling better. I just want to report on the progress that I have made in answering the interesting numismatic questions that you posed to me.

As to the names of the lever arms attached to the screw of a screw press, I still have not found a 17th or 18th century account in English. However, Sir John Craig, in The Mint, 1953, p. 164 gives a description that sounds like it was taken from a contemporary source:

"Two arms, each six feet long, loaded at the tip with 300 pounds of lead and furnished with two ropes projected from the top of the column at about waist height....."

"Normally four labourers, hauling on these ropes with the utmost violence of which they were capable, sent the column and die spinning down on a blank; as it rebounded, it was caught back by a lighter rope to prevent double striking, and wound up for a fresh blow. A moneyer seated in a pit before the opening flicked the struck coin away with his middle finger and with index and thumb set a fresh blank on the lower die. These ponderous machines worked at the astonishing pace of a blow every two seconds."

"A casual visitor in 1676.....saw 26 guineas struck in one minute by a press swung by three men, and an output of 30 shillings a minute was maintained throughout the working day in the great recoinage of 1696-8."

This tells us that a blow every two seconds was fairly standard, and that the screw did rebound. Calling the lever arm an "arm" is reasonable, and I take back my statement to you that the weights were called counterweights.

I have found a 1792 French description of the working of a screw press, and the lever arm is called simply a bar. In the 1884 German monograph Die Munztechnik, the lever arm is called a "Balancier" and the French name for the screw press may in fact have derived from the presence of such a lever arm, since the few French dictionaries at my disposal do give some meanings for balancier as a bar. I have only briefly scanned the 1792 reference, and will translate the pertinent descriptions for you this week. It is an extremely interesting work, and includes a long description and six plates of an early reducing machine. I'll send you more material as soon as possible.

All the best, with warmest regards!

As ever,

Peter Gaspar

Washington University
Campus Box 1134
One Brookings Drive
St. Louis, Missouri 63130-4899
(314) 935-6530

Harry E. Salyards, M.D.

NUMISMATIST

1003 WEST 11TH STREET
HASTINGS, NEBRASKA 68901
TELEPHONE (402) 463-6395

February 4, 1992

Mr. Eric Newman
6450 Cecil Avenue
St. Louis, Missouri 63105

Dear Eric,

Thank you for confirming your final topic for the Educational Forum at the EAC convention. It should, indeed, appeal to all collectors present.

Denis Loring is my other confirmed speaker thus far — depending if I get additional volunteers, and depending upon who they might be, I'm considering filling out the program with a kind of question and answer session, open to the audience, questions to be directed 'to the panel' at large. I'd be pleased to have your participation in that, as well.

Sincerely yours,

Harry Salyards

ERIC P. NEWMAN NUMISMATIC EDUCATION SOCIETY

6450 Cecil Avenue, St. Louis, Missouri 63105

February 5, 1992

Robert W. Julian
1003 Riverside Drive
Logansport, IN 46947

Dear Bob:

I finally found what I wanted and the quotation is partly incorrect as to facts.
Please find enclosed a copy of the material.

Sincerely,

Eric gs

Eric P. Newman

ERIC P. NEWMAN NUMISMATIC EDUCATION SOCIETY

6450 Cecil Avenue, St. Louis, Missouri 63105

James Spilman
P.O. Box 4411
Huntsville, AL 53815-4411

February 10, 1992

Dear Jim:

I am pleased that you as an engineer have thought about the problem of how the layer - on mechanism worked in minting in the late 18th century. I am unable to determine exactly how they centered planchets so well.

Wailes in 1829 was confused in my opinion. He recognizes the use of nippers, but states that they were used to impress the edges. That is impossible because he describes it as a thin piece of iron which opens. He is mixed up because the close collar (I call it the collar die) was introduced at the Mint in 1828.

How did the linkage feed the blank in, center it over the die, open to permit ejection of the struck coin, knock the struck coin out and push a new planchet out of the stack onto the lower die.

I am sending you the pictures and text which I know about. If you have more will you share it? Do you have an explanation of what actually happened?

This is a fun problem. I need it for a talk so please let me hear from you promptly.

My best,

Eric P. Newman

THE COLONIAL NEWSLETTER FOUNDATION, Inc. (205) 881-8678

4007 Medford Drive, SE
Huntsville, Alabama 35802

February 21, 1992

Mr. Eric P. Newman
6450 Cecil Avenue
St. Louis, MO 63105

Hi Eric,

Many thanks for the Xerox copy of the Bordley pamphlet for the CNL Library. I have not yet had the time to study the contents but will do so at the first opportunity. If you have any questions on what I am relating below, please give me a telephone call.

Regarding the planchet feeder illustrations:

The Droz Screw Press (Fig. 134 from Cooper) feeder is much better seen (in its fully developed form) in the illustration from Ansell's "The Royal Mint" which was reproduced on CNL page 773. ANS has a copy of Ansell and I would suggest that you have a slide made from the steel engraving which can be enlarged to see the detail, or projected for your audience.

The plan view of the device (Cooper Fig. 134) shows the feeder in the initial center position with a planchet in place directly above the lower die. After striking the "lower" section moves forward to the right and rolls the coin past the spring tip and ejects it into the bin behind the press. Then that section returns to the initial position, then -- the entire device, "lower" and "upper" sections together - retracts to the left below the feeder tube (see Ansell) where it receives a new blank planchet, then returns to the initial striking position. The lever arm, best seen in Ansell, operates from the weighted arms of the Fly. (If the left retraction were not used, a planchet could be placed by hand using finger position at a given point on the inside edge of the device to assure centering!)

The other illustration (Cooper Fig.47) is simply a much more primative form of the same general idea, probably designed to save a few fingers. It was most likely not a very effective solution to the problem.

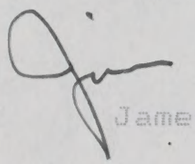
I take very serious issue with Cooper's statement, page 54, that "Marx Schwab could produce 'good round coins' (in 1550) and this indicated that he used a collar". What it DOES indicate to me is that he used a very well designed planchet cutter, possibly of the telescoping cookie cutter type! With the exception of the oval New Jerseys, the early American coppers are all much "rounder" than the mid-1500 European issues!

A final note on the Fly (or coinage screw press) in general:

Without question the vertical screw press form of machine was the most used and universal device of all early machinery. See my comments in CNL, page 785. Wine presses, book binders, etc & etc all made extensive use of the basic mechanism. The screw presses - the Flys - made for coinage usually had a "fast" square (Acme) right-hand thread. This sort of thread could run in almost anything, even some pegs mounted in a block. It could be easily cut or cast; the mating "nut" of the frame could also be easily cut, or cast in sections, or as inserts called nuts, and all of these methods seem to have been used (Richard Doty's comments at the recent ANS conference notwithstanding!). Also -- the Fly alone was not always complete -- see Sellers' observations (reference CNL page 781) regarding overhead restraining beams and chains at the first US Mint. Such ancillary mechanisms would do much toward controlling planchet (die) pressure and restraining travel to prevent die clashing, etc. as well as making the swingers work more effective!

Hope all this helps, Eric. Please telephone if you would like to discuss any of this further --

Best regards,
THE COLONIAL NEWSLETTER



James C. Spilman

P.S. How goes the work on the Virginia coinage revision? I had hoped to see it in print by now! JCS

THE COLONIAL NEWSLETTER FOUNDATION, Inc. (205) 881-8678

4007 Medford Drive, SE
Huntsville, Alabama 35802

February 21, 1992

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6450 Cecil Avenue
St. Louis, MO 63105

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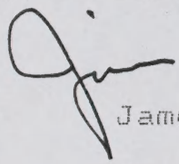
Best regards,
THE COLONIAL NEWSLETTER



James C. Spilman

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THE COLONIAL NEWSLETTER FOUNDATION, Inc. (205) 881-8678

4007 Medford Drive, SE
Huntsville, Alabama 35802

March 5, 1992

Mr. Eric P. Newman
6450 Cecil Avenue
St. Louis, MO 63105

Hi Eric,

Thanks for your telephone call regarding the material in my letter of 2-21-92. After thinking about your questions I can see where I could have done a much better job of expressing my ideas which were pretty cryptic, I admit. I do have a problem at the moment and that is that wife and I have two one-week Elderhostel programs scheduled during March and another during April, then we leave for England in June, plus I have an issue of CNL to get into the mail before the end of March. (Plus my annual battle with the Infernal Revenue Service!). The bottom line is that I have run out of time and have decided that I will not be able to make the "feeder" mock-up in time for your April meeting. However, I think I can provide enough clarification in words to be of help with your April meeting, so here goes -- (plus several other ideas that have popped up as I went along that I would like to explore with you).

Item A. Figure 134 from Cooper. First, Eric, I believe that the device illustrated here (and dated by Cooper as 1803) is ONLY an ejection device, it is NOT a feeder! This is important. It does have an opening motion when the small pin in the tapered slot just to the right of the pivot "r" is driven into the taper; however, note that the "ejector" fits between two fixed metal plates and moves back and forth when it is pushed by the rod (Fig. 15H) which is operated by the "eccentric groove", which I believe is a slotted sector cam, and which pivots about point y on the frame of the press; the pin would be secured on one of these fixed plates. The little lever or projection in Fig. 18 which the rod engages seems to be marked with the Greek letter lambda in both views (?). Now -- IF the double circle on the mounting plate which is marked "T" is an opening and the assembly moves far enough to the left between the fixed plates, then that MIGHT be an insertion point for a blank planchet, but I don't believe that it is. However -- read on.

Item B. The Ansell press, which Cooper also illustrates on Page 135, is somewhat later in time, about 1812 to 1830 era, and here you can see quite well the design of the "feeder" and there is no question that it is both feeder as well as ejector! And -- that it is without any doubt the same basic design as the one on the earlier Droz press! The operator stacks planchets into a short vertical tube as well as bopping with the hammer those which might be warped or have severe "hang nails" (my term) from the planchet cutter. The vertical tube appears to me to have the capacity for about 10 or 15 planchets!

Item C. Boulton's Specification: AD 1790 --- No. 1757. (On Xerox page 135 which you sent to me.) In Figure 138 Cooper shows the first page of Boulton's seven page specification "Application of Motive Power, etc". I trust you have this specification and drawings in your files, Eric. If not let me know and I will send copies to you. There has been some horrible misinformation published about this "machine" by several individuals, a George Ewing among them. To make a long story short -- this "machine" installed in the London Mint by Boulton was NOT, I believe, a coinage press. It was instead only a planchet cutter that could cut any size planchet needed by the Royal Mint simply by feeding the strip into the proper one of the eight cutting devices. The machine was so large that it required a special building and foundation for support, plus made so much noise that the workers needed ear plugs when operating it. It suffered numerous breakdowns and really screwed up the mint's production schedule! (Most of this latter information is from memory but the source is either Ansell or Craige "Newton at the Mint").

Item D. The ANS "Groves" fund. Who in the world is/was "Groves"? It seems to have funded some really screwball "research" from time to time! So far as I can determine there has never been an ANS member named Groves!

Enough for now, and I sincerely hope that this will be of help to you for your April meeting. I find that I cannot describe to you in words the relative "sliding" motions of the feeder/ejector device; that must stay on hold until I can get the mock-up completed, but it has to do primarily with the way the fixed pins in the stationary mounting plates interact with slots and the translational motion of the feeder/ejector device.

Again, Eric, telephone if you need additional clarification. I may be able to help, or I may not. This thing is not a simple device but a rather complex gadget with a lot of monkey-motion!

One of the goals of CNL, from the beginning, has been someday to build up all of the various minting devices of the Early American era and actually test them to see what we can learn from the process. A complete Early American minting facility! It will probably never happen in my lifetime, and it will cost a bundle, but I do not doubt that someday it will come into being! I sort of hope oneday to purchase the Machin's Mills site on Orange Lake (I visited there last year) and do the "restoration" on that site. Again, it requires funding which we do not have today.

Next time I will pass along to you some of my thoughts about what could be done with your revised 1773 Virginia material.

Finally, have I told you that I purchased at auction the J.P.Droz hub (ex-Ray Williamson) for the CNL collection? I trust that you had a chance to examine it a few years back when Ray had it on display at ANS. We will learn a lot from that artifact when the proper tests are performed on it.

More later -- in great haste, as usual!

Best regards,
THE COLONIAL NEWSLETTER

James C. Spilman

THE COLONIAL NEWSLETTER FOUNDATION, Inc. (205) 881-8678

4007 Medford Drive, SE
Huntsville, Alabama 35802

March 14, 1992

Mr. Eric P. Newman
6450 Cecil Avenue
St. Louis, MO 63105

Hello again, Eric --

One more idea that we did not discuss regarding the ejector on Cooper Fig. 136 that someone may ask you about -- we discussed on the telephone the pin and the tapered slot near the center which would cause the jaws to open if the pin moves to the left (down) position. We did not discuss the other pin at the right edge of the sketch and the curved cutout in the right side. This pin obviously causes the jaws to close when that pin moves right (up).

BUT -- note that these two pins are only spaced apart approximately the width of the planchet, which if we assume is a 1/2d means that the pins are about one inch apart, or so. However, to operate effectively the entire assembly must move at least 12 inches in its back & forth travel as the push rod toggles the motion from the overhead fly arm and sector!

SO -- the plate on which these two pins are mounted, defined in the sketch by the letters m-l-n-h (I think) must, in turn, be mounted in a long slot in the lower support plate (not shown in the drawing), and that slot would need to be long enough for the plate m-l-n-h to slide about six inches each direction, and the sliding plate would need to hit a stop, possibly just the end of the slot or a pin within the slot, to stop the motion of the plate. THEN -- as the assembly continues sliding on the plate for the next inch, the pins would cause the jaws to function, -- open or close -- depending on which direction the overall device is moving.

So, my conclusion then is this device COULD serve both as a feeder and as an ejector because the jaws would remain open throughout the entire travel after ejection until the sliding plate hit the stop at the other end of the slot, and then it would close during the final inch, or so, of travel.

IF a planchet could be inserted between the jaws just before they closed on the return cycle, then it would be gripped tightly (depending on the dimensions of the jaws relative to the planchet) until it reached a position over the dies, when it must stop for a moment to receive the strike.

In the sketches that we have here in Cooper, there appears to be no way for the mechanism to provide a stop motion during travel

EXCEPT at the far left (down) position. That is the basis for my thinking that the assembly ONLY performs an ejection function. If the stop position is over the die, then a planchet could be placed by hand, the jaws would close on it, the strike would occur, the assembly would move right (up) until the jaws open and the planchet drops behind the press.

In the Ansell drawing I believe that the automatic feeder HAS been developed (perfected) and thus is a much advanced version of the same assembly seen in Cooper Fig. 136.

The outside pin appears to have a spring or some such attached to it, similar to the one at the far upper end but not as long, and those must have a delaying function of some sort, but I have yet to figure out what it is. This must wait, I fear, until I can find time to construct a working model of the assembly.

I hope that this will both expand and clarify my thinking Eric, it is not easy to express these ideas over the telephone, or without a model to work with. Hope this helps!

Best regards,
THE COLONIAL NEWSLETTER

James C. Spilman

THE COLONIAL NEWSLETTER FOUNDATION, Inc. (205) 881-8678

4007 Medford Drive, SE
Huntsville, Alabama 35802

March 19, 1992

Mr. Eric P. Newman
4450 Cecil Avenue
St. Louis, MO 63108

Hello again, Eric --

One more idea that we did not discuss regarding the ejector on Cooper Fig. 136 that someone may ask you about -- we discussed on the telephone the pin and the tapered slot near the center which would cause the jaws to open if the pin moves to the left (down) position. We did not discuss the other pin at the right edge of the sketch and the curved cutout in the right side. This pin obviously causes the jaws to close when that pin moves right (up).

BUT -- note that these two pins are only spaced apart approximately the width of the pinochet, which if we assume is a 1/2d means that the pins are about one inch apart, or so. However, to operate effectively the entire assembly must move at least 12 inches in its back & forth travel as the push rod toggles the motion from the overhead fly arm and sector!

SO -- the plate on which these two pins are mounted, defined in the sketch by the letters n-l-m-n (I think) must, in turn, be mounted in a long slot in the lower support plate (not shown in the drawing), and that slot would need to be long enough for the plate n-l-m-n to slide about six inches each direction, and the sliding plate would need to hit a stop, possibly just the end of the slot or a pin within the slot, to stop the motion of the piece THEM -- as the assembly continues sliding on the plate for the next inch, the pins would cause the jaws to function, -- open or close -- depending on which direction the overall device is moving.

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Best regards,
THE COLONIAL NEWSLETTER

James C. Spilman

ERIC P. NEWMAN NUMISMATIC EDUCATION SOCIETY

6450 Cecil Avenue, St. Louis, Missouri 63105

James Spilman
4007 Medford Dr. SE
Huntsville, AL 35802

March 19, 1992

Dear Jim:

Your March 14, 1992 letter was a relief to me. I had concluded that the pins which opened and closed the nippers had to move and you have so stated. I thank you for your explanation as I was thinking that whoever drew that nippers slider didn't pass mechanical drawing 101.

I have read the descriptive passages in the books again and again and I believe that on the down stroke of the upper die the first thing that happens is that the nippers opens before the nippers slides back longitudinally otherwise the planchet would be knocked out of place. After the nippers opens the longitudinal movement will not disturb the planchet nor will the toothpick on the end interfere with the set planchet. If the nippers was in an open position before the planchet was set onto the die the planchet would not always end up on top of the die. As the down motion of the upper die continues the nippers pulls away from the dies, under the stack and a planchet drops in front of its 90 degree element at the same time the strike of the coin occurs.

On the rising stroke of the upper die the nippers first closes to hold the new planchet and carries it to the position over the lower die. The tooth pick and the outside curve of the movable arm of the nippers get to the die first and knock off the struck coin. If the coin is still on the lower die the outside curve of the nippers end shoves it off. If the struck coin has slid to one side the toothpick knocks it off. If the struck coin dropped from the upper die or bounced off there is nothing to push off. When the planchet is held by the nippers just over the lower die, the planchet fall only a trifle, as it is virtually on the die already.

If the foregoing is correct then the vertical pins must slide to the proper position to open the nippers before the backward slide motion begins and must close before the forward slide motion begins. You note the projecting horizontal pin. I bet these are the way the slider's movement is delayed until the jaw opens or closes.

I see the peculiar bug-like things next to the pins. I thought they might be a letter but they look like a spring. What do you think they are ? They are both in the same position relative to the pin. Each pin also operates as a stop or limiter to keep the jaws from opening too far or closing too hard.

The slide must be thinner than the planchet. Each planchet size must have a different nippers size.

When you get around to making a mock up you will solve the problem for us.

I am going to give my talk and ask the EAC audience to help. They are the coin experts. Maybe they will have suggestions. I wish Droz or Boulton would correspond with us.

Thanks again for your cooperation.

Sincerely,

Eric P. Newman

P.S. The date of the supplement to Bordley is positively 1790 as we found it in a Philadelphia newspaper, just as the 1789 publication had been.

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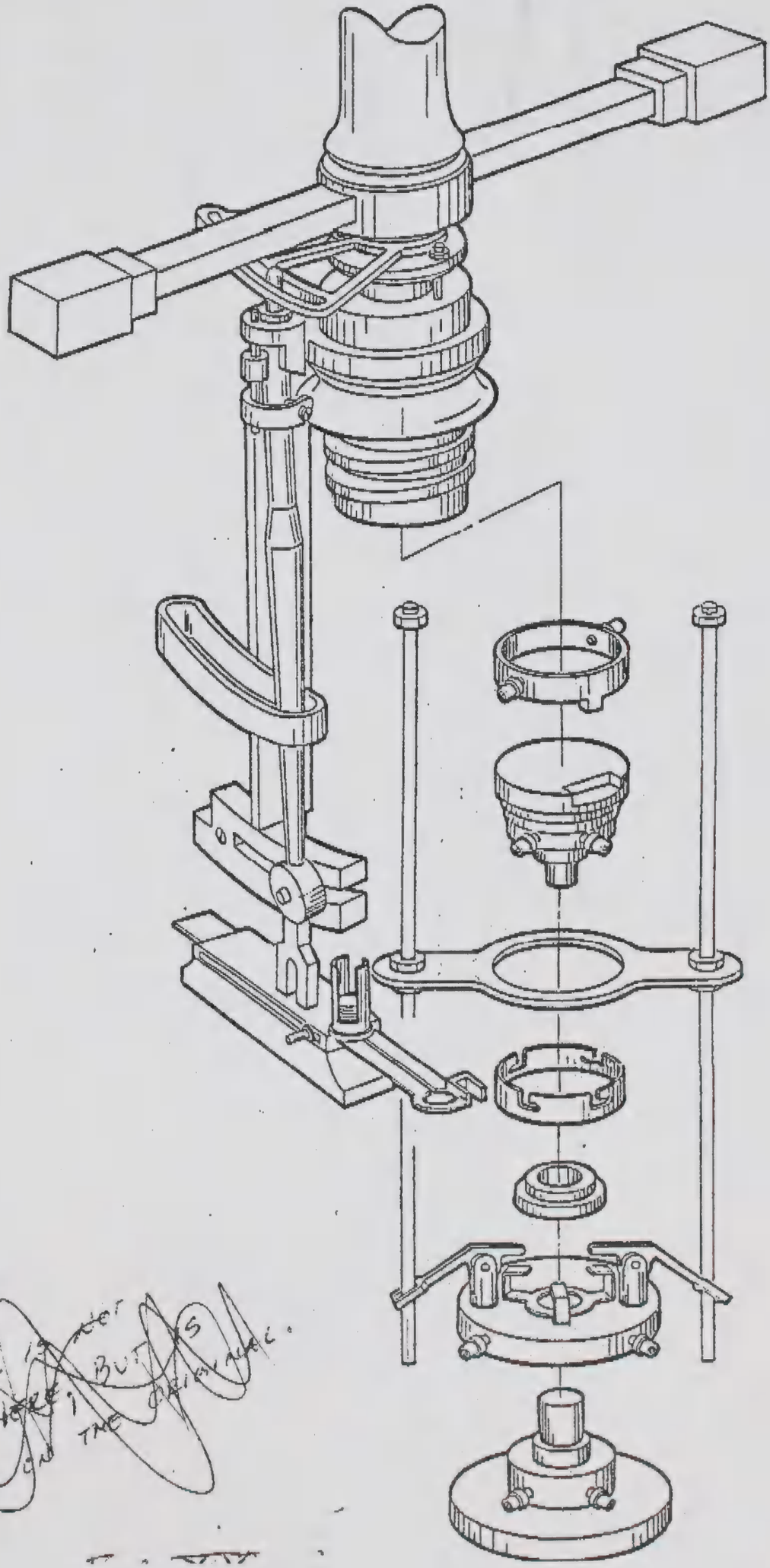
Fax Transmittal Memo 7672

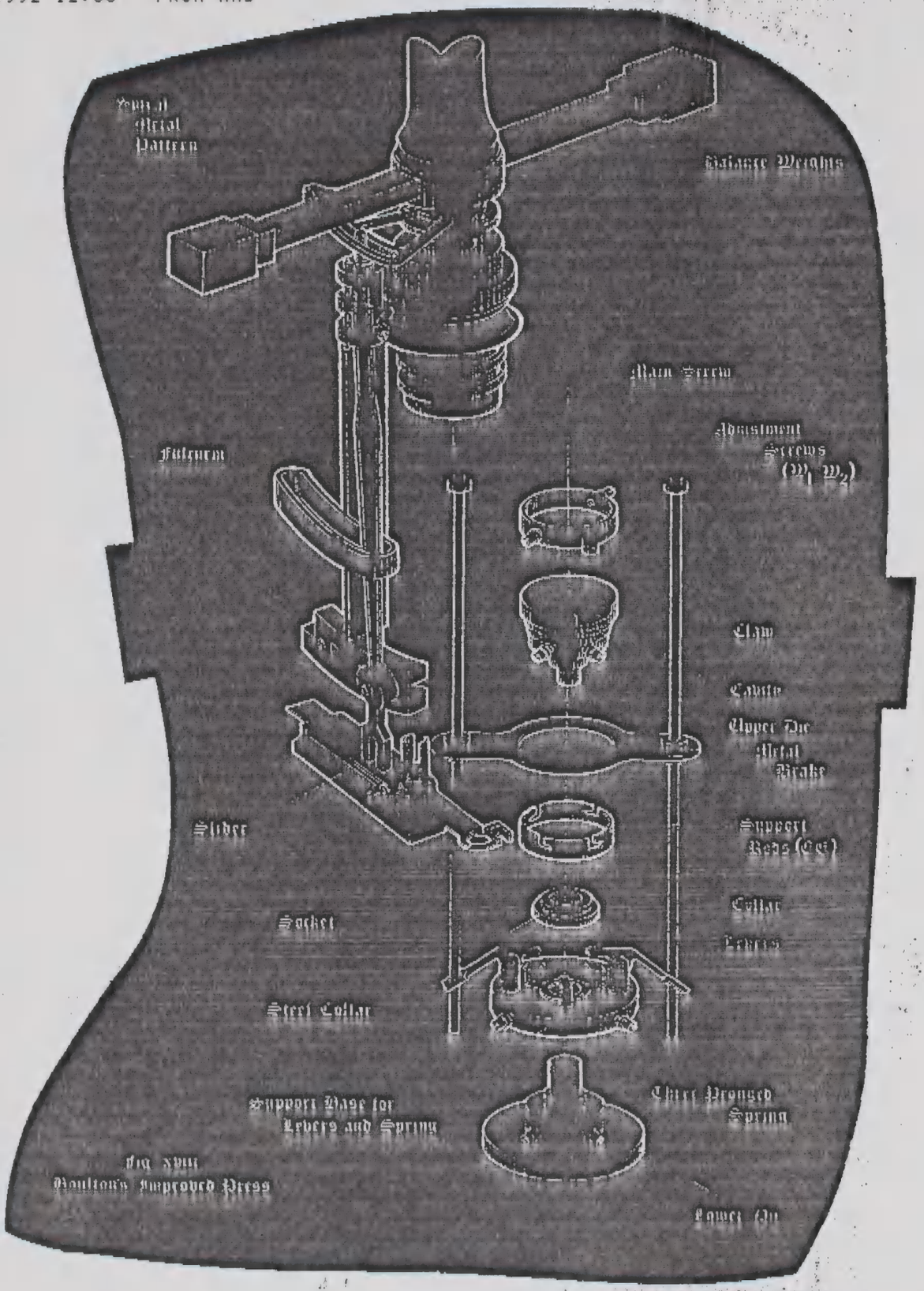
To	E. P. NEWMAN	No. of Pages 6	Today's Date 4/1/92 Time
Company	Edison Bros.	From	L A ELAM
Location	—	Company	
Fax #	314/331-6554	Location	Dept. Charge
Telephone #		Fax # 212/234-3381	Telephone # 212/234-3130
Comments		Original Disposition: ☐ Destroy ☐ Return ☐ Call for pickup	

Eric -

Turns out what I was thinking of is Ewing's article "Matthew Boulton and the Development of the U.S. Mint" which is scheduled for AJN 3/4 (1992) The relevant pages + illustrations follow.

LAE
4/1/92




Balance Weights
Main Screw
Adjustment Screws (W_1 W_2)
Fulcrum
Claw
Cavity
Upper Die
Metal Brake
Slider
Support Rods (2 ea)
Collar
Socket
Levers
Steel Collar
Support Plate for Levers and Spring
Three Pronged Spring
Lower Die

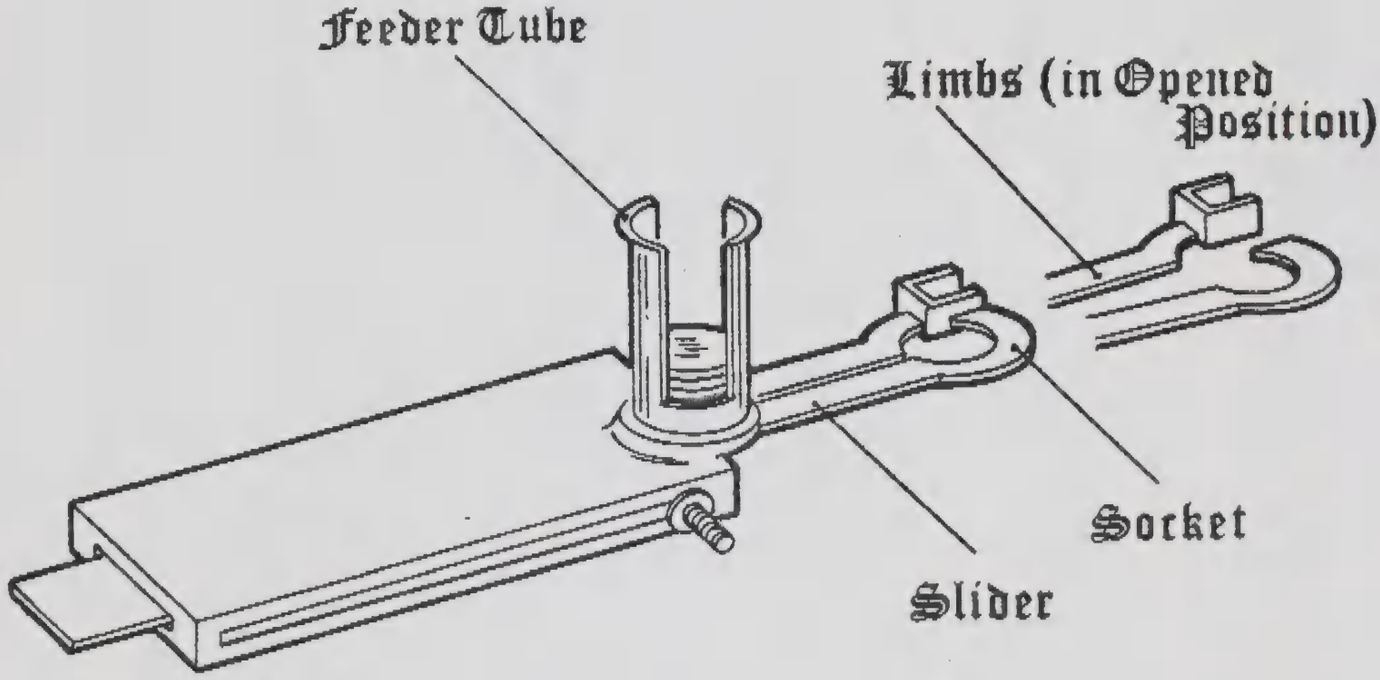


Fig. XXVII

Slider Jaws Closed and Opened

hole that fitted the neck of the screw. When the screw made a complete revolution, the lever followed the spiral curve and moved the opposite end of the lever in forward and backward movement. The lever was forked at the end and gave motion to a slider.

This lever pushed the slider forward in its socket and carried the planchet forward, placing it on the bottom die (Fig. ~~XXVII~~ 24) The circular end of the slider pushed the preceeding planchet off the die. The screw was now withdrawn to its original starting point. The slider now reached its extension and the studs inside the slider mechanism caused the limbs to open,placing the planchet upon the lower die.

As the screw started another descent, the ring was pushed upwards to enclose the blank planchet that would receive the next impression. The slider returned to the feeder tube to take another planchet.

The feeder unit consisted essentially of a tube into which the blanks were stacked, a socket and a slider. The entire assembly was dependent upon a lever and fulcrum attachment to the press. The slider, operating within the trough, was a thin steel plate formed of two pieces hollowed out on the sides and held together by screws. At the extreme end was a circular hold. When the two sections or limbs of the slider closed, they grasped the coin, holding it by the edge. When opened, the coin dropped out.

A plate was applied flat beneath the trough with one edge turned up and applying to the upright edge of the trough. The tube containing the blanks was open at the bottom to the slider, the pieces resting upon it. The sliding piece was made to move the steel slider within the trough by means of three studs projecting upward from the bottom plate of the slider. One stud was positioned at the front of the plate. It was this wedge-shaped stud that separated the limbs of the slider. The back two studs were also diamond shaped and caused a pinching motion when the slider retracted which caused the limbs to close. This whole process was dependent on correct placement

130

G. E. Ewing

When the screw of the press screwed down, the slider was retracted, the circle at its end coming exactly beneath the tube . The limbs being open, a blank dropped from the tube into the circle of the slider, then the screw of the press, in returning, and by the action of a lever , closed the limbs upon the blank piece. The studs, having found a reaction, pushed the slider forward in the trough, carrying the blank forward to the die, which in turn, pushed off the last piece struck.

How largely automatic Boulton had rendered the operation of coining is shown by the statement that the labour required was only that of boys, and even then it did not entail hard work; in other words, the feeding of the blanks and the removal of the coins, when struck, were automatic.

Need subtext

By June 8, 1799, Matthew Boulton was still trying to establish a fully equipped mint for the United States. This is documented by the letter from Matthew Boulton to Elias Boudinot.

Document 70, TRANSCRIPT

London, June 8 1799

Elias Boudinot Esq

Sir

I have this moment received from my House at Soho at Birmm. an extract of your favr. dated ye 20th March. As yesterday was the day for making up the American Mail I fear this may be too late, but I am unwilling to loose the chance of sending you a short letter to say that I have orderd Ten Ton of Blanks to be prepard for you in 2 Weeks & if no Ship is at that time upon the Birth at Bristol or at Liverpool I have in that case ordered 20 Tons to be

Mr. Terry Stahurski
1519 Prospect Ave.
Rocky River, Ohio 44116

June 1, 1992

Mr. Eric P. Newman
Eric P. Newman Numismatic
Education Society
6450 Cecil Ave.
St. Louis, MO 63105

Dear Mr. Newman,

Enclosed please find a set of the photographs from the EAC that you requested. I am sorry that it took me so long to get these to you; however, I have been doing a lot of traveling and only recently have I been able to get to my mail. I have enclosed a couple of additional photographs in case you would like them. Another set was sent to Wayne Homgren for possible use in his upcoming article on your wonderful library.

As an engineer, I thoroughly enjoyed your lecture at the EAC. I find it fascinating that we know so much about early coppers but comparatively so little about the mechanisms that manufactured them. Being a mechanical engineer, I love to contemplate the actual forces, materials, etc., involved in minting these pieces. Enclosed are a couple of sheets of calculations based on some of your comments from the EAC talk. I was trying to determine the amount of force necessary to turn a screw press, and if indeed several men could mint one coin every three seconds. Naturally, these calculations are based on many assumptions; hence, the values could vary tremendously. Many of these calculations may have already been determined; but, I enjoyed the exercise anyway. Please treat it as a "first pass" attempt to try to get some values, however inaccurate.

Finally, I want to thank you for your hospitality and the wonderful time at the Mercantile Bank Museum. The convention was wonderful (the best I have attended) primarily because of you and Tett. Thank you and best regards.

Sincerely,

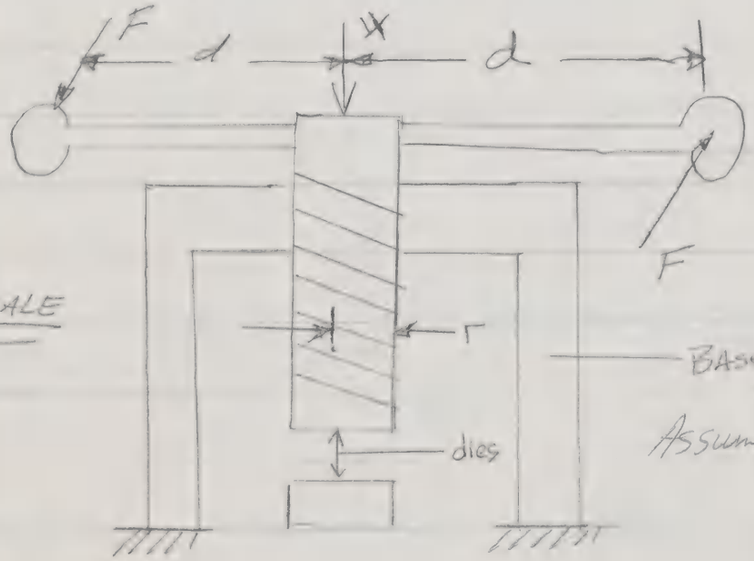
Terry Stahurski

TS/kjk
encl.

Q. What is the force necessary to turn a Colonial style screw press and could one coin be produced every three seconds?

In engineering textbooks, threads (primarily square-threaded screws) can be modeled with an analysis similar to a block sliding along an inclined plane.

Considering the press shown below, the screw carries a load W (which is supported by the base of the press). Contact between screw and base takes place along a portion of the threads. By applying forces F to the press handles (levers), the screw may be made to turn to raise or lower load W.



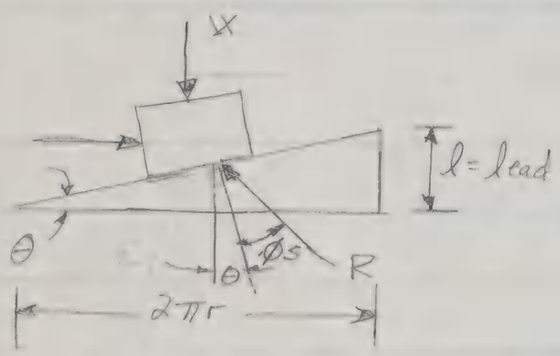
NOT TO SCALE

r = radius of screw thread

Assume d = 5 feet = 60"

"Unwrapping" one of the screw threads is shown in the free body diagram below. The slope of the was obtained by plotting horizontally the product $2\pi r$, where r is the mean radius of the threads, and vertically the

lead L of the screw (the distance the screw travels in one complete turn). The angle θ is the lead angle. Since frictional force does not depend on contact area, the two threads may be assumed to be in contact over a much smaller area then what they actually are and represented by the inclined plane and block shown below.



W = load on screw (dies)

Q = force on block having same effect as F on handle

R = Resultant force (combination of frictional force on block and normal force on block)

ϕ_s = angle between Normal and resultant force. $\phi_s = \arctan \mu_s$ (μ_s Coefficient of friction between screw threads)

θ = lead angle

Relationship between the forces on the handle of the press and the forces on the inclined plane:

$$2Fd = Qr$$

or $$F = \frac{Qr}{2d}$$ (F is the force we're looking for)

Therefore, we need to find r & Q.

Assume an r of 2" (diameter of screw threads 4")

$$\tan\theta = \frac{l}{2\pi r} \quad \text{with } r = 2"$$

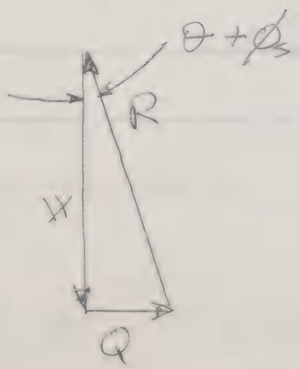
$$\therefore \tan\theta = \frac{l}{4\pi}$$

To determine l: Per E. Newman talk, in a 90° turn, the die travels about 1½". Therefore in a full turn, travel (lead) equals 6"

$$\therefore \tan\theta = \frac{6"}{4"\pi} = .476 \quad \text{or} \quad \theta = 25.5°$$

(Note: the value for θ (helix angle on the screw) may already be known based on screw thread designs recorded in texts from the period. The value obtained above looks big to me. I would assume it to be about half, or less, than the value calculated).

To determine the force Q, a force triangle needs to be constructed (below) showing the relationship between W, Q, R, θ & ϕ_s.



ϕ_s = arctan μ_s (frictional coefficient)
For metal-to-metal contact
$\mu_s = 0.30 \therefore \phi_s = 16.7°$
(Note: Assuming worst case - no lubrication)

From the force triangle:

$$W = \frac{Q}{\tan(\theta + \phi_s)}$$

or $Q = W\,[\tan(\theta + \phi_s)]$

From G. Newman talk, force on the planchet, W, ranges between 20,000 – 60,000 lbs. Let's chose an average of 40,000 lbs

$$\therefore \quad Q = 40{,}000\text{lb}\,[\tan(25.5° + 16.7°)] = 36{,}269 \text{ lbs}$$

$$\text{recall } F = \frac{Qr}{2d} = \frac{(36{,}269 \text{ lbs})\ 2''}{2\ (60'')} = \underline{\underline{604 \text{ lbs}}}$$

Therefore 604 lbs would be needed on each end of the handles, with the assumptions made above, to exert the forces needed to manufacture a coin. This is probably possible with 2 men at each end of the die.

Note that by lubricating the threads the coefficient of friction decreases tremendously and can be as low as 0.095 (on an average) $\therefore \quad \phi_s = \arctan .095 = 5.4°$

This causes Q to decrease to: 23,965 lbs.

and the force applied to each end of the handles = $\underline{\underline{900 \text{ lbs}}}$.

It's amazing what a little grease can do!

Also note that lifting the dies (unscrewing) would require less force and thus be considerably easier and less tiring on the workers.

From an ergometric point of view, how much movement would be involved for a worker to mint one coin every three seconds?:

$$20 \frac{\text{strokes}}{\text{min}} \times \frac{\pi d}{4} \left(\begin{array}{c} \text{\# feet workman walks} \\ \text{per stroke} \end{array} \right) \times 2 \left(\begin{array}{c} \text{upward \& downward} \\ \text{stroke} \end{array} \right)$$

$$= 156 \frac{\text{ft}}{\text{min}} = 1.78 \text{ miles per hour}$$ (one can fairly easily walk at a pace of 3 miles per hour)

Therefore a workman could probably accomplish the task; however, the amount of force he would apply to each stroke would take it's toll. My guess is that these workmen would trade off with fresh work crews every 20-30 minutes or so.

Note: Just a few final comments. An assumed stroke of 1½" is probably too large and creates a large helix angle. My guess is that the stroke was smaller which would decrease the amount of force necessary to mint the coins. If actual physical measurements are known, they can easily be plugged into these equations.

T. Stotowski
6-1-92

ERIC P. NEWMAN NUMISMATIC EDUCATION SOCIETY

6450 Cecil Avenue, St. Louis, Missouri 63105

Terry Stahorski
1519 Prospect Ave
Rocky River, OH 44116

June 9, 1992

Dear Terry:

I am very grateful for the pictures taken at the EAC meeting in St. Louis, but much more grateful for your comments as to the forces exerted on screw press dies. I am so glad you enjoyed the St. Louis EAC convention.

I never dreamed I would have mechanical engineers and stamping experts in the audience, but I am glad I did. I had gathered all the historical and numismatic evidence I could and the rest was left to all of you. I thus enjoyed the input by the audience immensely. Why don't you write your thoughts for publication in Pennywise?

I will continue to study your assumptions and conclusions on the mechanism. I want to throw in a few curves. There were leather straps tied to the bar handles so that the operators could jerk the bar from a greater distance out from the turning axis. This helped avoid a jolt to the operator when the striking occurred and permitted him to hold on to the strap as the screw recoiled. Then his next pull would not require much change of his position. If he had a partner at the opposite side of the bar then after several strikes his partner could take over. This would let each one let go his strap after several strikes when the other took over. This gave each operator a short rest. The strap naturally increased the mechanical advantage as well.

My best,

Eric P. Newman

EPN/ts

Bolster

Square + octagonal

Counter weight

Swinging bar
Inertial weights

Springs by 1792 in France

Half of coins struck by top die
offset sufficient to release
easily.